Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE – SEMESTER – VI EXAMINATION – WINTER 2015**

**Subject Code:161601** **Date:14/12/ 2015**

**Subject Name: Modeling Simulation and Operation Research**

**Time:2:30pm to 5:00pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** PQR feed company markets two types of feed for cattle. The first mix, Fertilex, requires at least twice the amount of wheat as barley. The second mix, Multilex, requires at least twice the amount of barley as wheat. Wheat costs Rs. 1.5 per kg and 1000 kg is available per month. Barley costs Rs. 1.25 per kg and 1200 kg is available per month. Fertilex sells for Rs. 1.8 per kg up to 99 kg and every additional kilogram sells for Rs. 1.65. Multilex sells for Rs. 1.7 per kg up to 99 kg and each additional kilogram sells for Rs. 1.55. Bharat farms will buy any and all amount of both mixes of PQR feed company. Formulate the LPP for this problem. **8**

**(b)** **Solve following LP problem using Graphical Method:** **06**

Maximize $Z = 10x_1 + 15x_2$

S. t.

$$2x_1 + x_2 \leq 26$$
$$2x_1 + 4x_2 \leq 56$$
$$x_1 - x_2 \geq -5$$
$$x_1, x_2 \geq 0$$

**Q.2** **(a)** **Solve following LP problem using Simplex Method:** **08**

Maximize $Z = 10x_1 + 20x_2$

S. t.

$$x_1 + x_2 \leq 200$$
$$x_2 \leq 150$$
$$3x_1 + 6x_2 \leq 600$$
$$x_1, x_2 \geq 0$$

**(b)** What is the difference between Slack, Surplus, and Artificial variable? How do they differ in their structure and utility? **06**

**OR**

**(b)** Explain concept of shadow price. What is its utility? Discuss with the help of an example. **06**

**Q.3** **(a)** Why is VAM the best method to generate the initial feasible solution? Why is it called a 'penalty method? Discuss **06**

**(b)** Consider a scenario where four different jobs can be done on four different machines. The set-up and takedown time cists are assumed to be prohibitively high for changeover. The matrix shown below gives the costs in rupee of processing job 'i' on machine 'j'. How should the jobs be assigned to the various machines so that the total cost is minimized? **08**

| **Job** | **Machines** | | | |
|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ |
| **A** | 5 | 7 | 11 | 6 |
| **B** | 8 | 5 | 9 | 6 |
| **C** | 4 | 7 | 10 | 7 |
| **D** | 10 | 4 | 8 | 3 |

**OR**

**Q.3** **(a)** Why is the assignment problem a special case of transportation problem? Discuss **06**

**(b)** Solve the following transportation problem and find its optimal solution, where the transportation costs, availabilities, and supplies are as given in table below. **08**

| | **D** | **E** | **F** | **G** | **Availability** |
|---|---|---|---|---|---|
| **A** | 12 | 10 | 12 | 13 | 600 |
| **B** | 7 | 11 | 8 | 14 | 400 |
| **C** | 6 | 16 | 11 | 7 | 300 |
| **Demand** | 230 | 200 | 450 | 420 | |

**Q.4** **(a)** What are the differences between AOA convention and the AON convention of constructing the project network? Explain with the help of an example. **07**

**(b)** What is Minimum Spanning Tree? Explain an algorithm to find the minimum spanning tree with the help of an example. **07**

**OR**

**Q.4** **(a)** Why is replacement of items required? Distinguish between individual replacement and group replacement policies. **07**

**Q.4** **(b)** The cost of a machine is Rs. 6100 and its scrap value is Rs. 100. The maintenance costs found from experience are as follows: **07**

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Maintenance Cost | 100 | 250 | 400 | 600 | 900 | 1200 | 1600 | 2000 |

When should the machine be replaced?

**Q.5** **(a)** A True value machining has two machines (M-I and M-II) used for processing different parts. The completion time of these parts on both the machines is dynamic and is subject to variation. The past data are summarized as below. Simulate the problem to determine expected product completion time using following random numbers. **08**

For M-I - 24, 92, 79, 39, 78, 33, 91, 27, 46, 30, 27, 92, 88, 63, and 22

For M-II – 29, 92, 59, 81, 33, 5, 58, 84, 13, 84, 85, 53, 95, 75, and 33

| **Process time (Min.)** | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|
| **M – I** | 0.10 | 0.15 | 0.25 | 0.30 | 0.15 | 0.05 |
| **M – II** | 0.20 | 0.35 | 0.15 | 0.15 | 0.1 | 0.05 |

**(b)** What are the assumptions in queuing theory? Explain the concept of Jockeying, Balking and Reneging. **06**

**OR**

**Q.5** **(a)** A company is considering the construction of two repair facilities, each having different financial implications. On average, 20 trucks require repairs each day and the arrivals are Poisson distributed. The loss of revenue in terms of opportunity cost loss to the firm of having truck in repairs is estimated to be Rs. 5000 per day. **08**

| **Characteristics** | **Facility A** | **Facility B** |
|---|---|---|
| **Installation Cost in Rs.** | 20,00,000 | 60,00,000 |
| **Labor Cost per day (Rs.)** | 10,000 | 15,000 |
| **Repair Rate** | 30 | 50 |
| **Arrival Rate** | 20 | 20 |

There are 280 working days in year. The three facilities being considered have the following characteristics. Determine which facility the company should prefer.

**(b)** What is the essential difference between resource leveling and resource smoothing? Explain with the help of an example. **6**

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